The Adaptive Ecosystem Climatology (AEC)*

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*Patent Pending

Adaptive Ecosystem Climatology

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"Earth Science Applications: Ecological Forecasting for Conservation and Natural Resource Management"

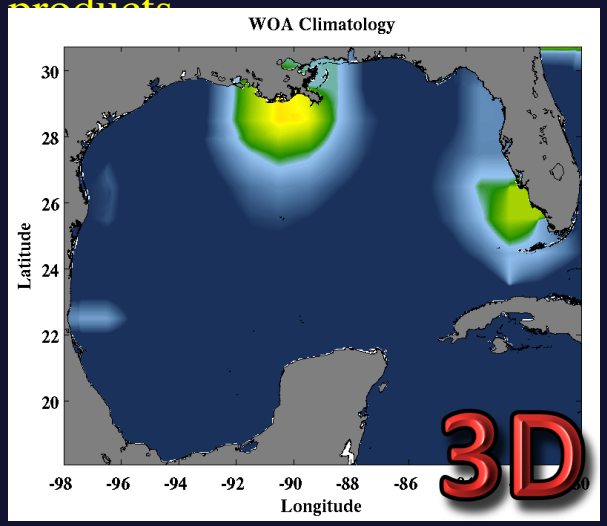
Partner/End-User Organizations:

NOAA National Centers for Environmental Information
NOAA Atlantic Oceanographic and Meteorological Laboratory
NOAA Southeast Fisheries Science Center
EPA Gulf Ecology Division
BOEM Gulf of Mexico Region

Adaptive Ecosystem Climatology - Purpose

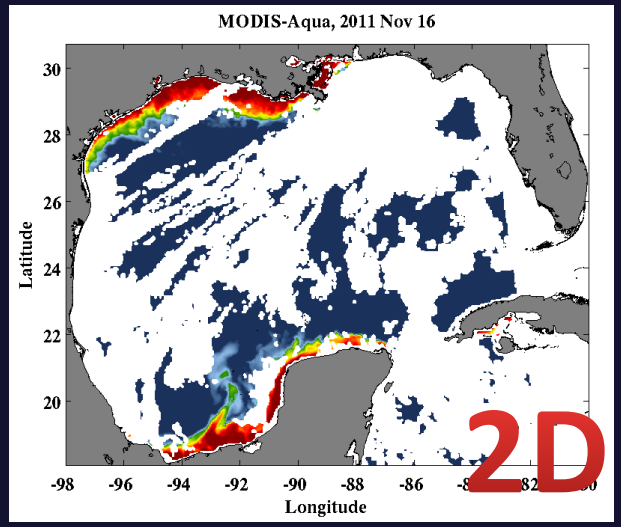
Aid the decision-making process for conservation and natural resource management, which often relies upon:

Historical *in-situ* measurements/climatological products



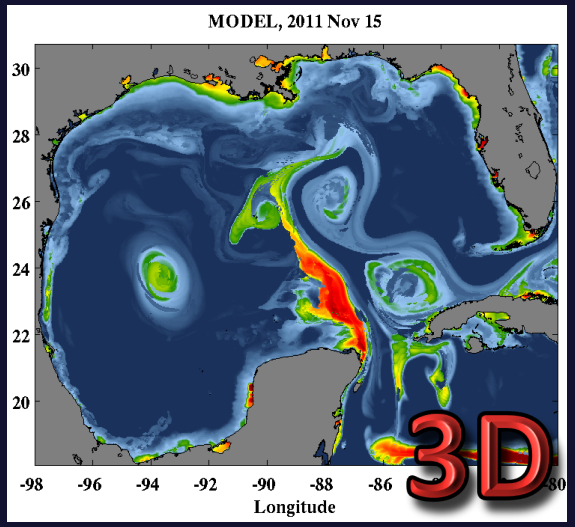
- Expensive and time consuming to collect
- Gaps and temporal/spatial aliasing
- Spatially and temporally coarse (monthly or seasonal)

Earth Observations



- Surface only (2D)
- Data gaps (clouds, etc.)
- Near-shore signal contamination

Models



- Assumptions and simplifications
- Require specialized skill
- Require high-performance computing resources
- Require initialization and boundary conditions

Adaptive Ecosystem Climatology - Background

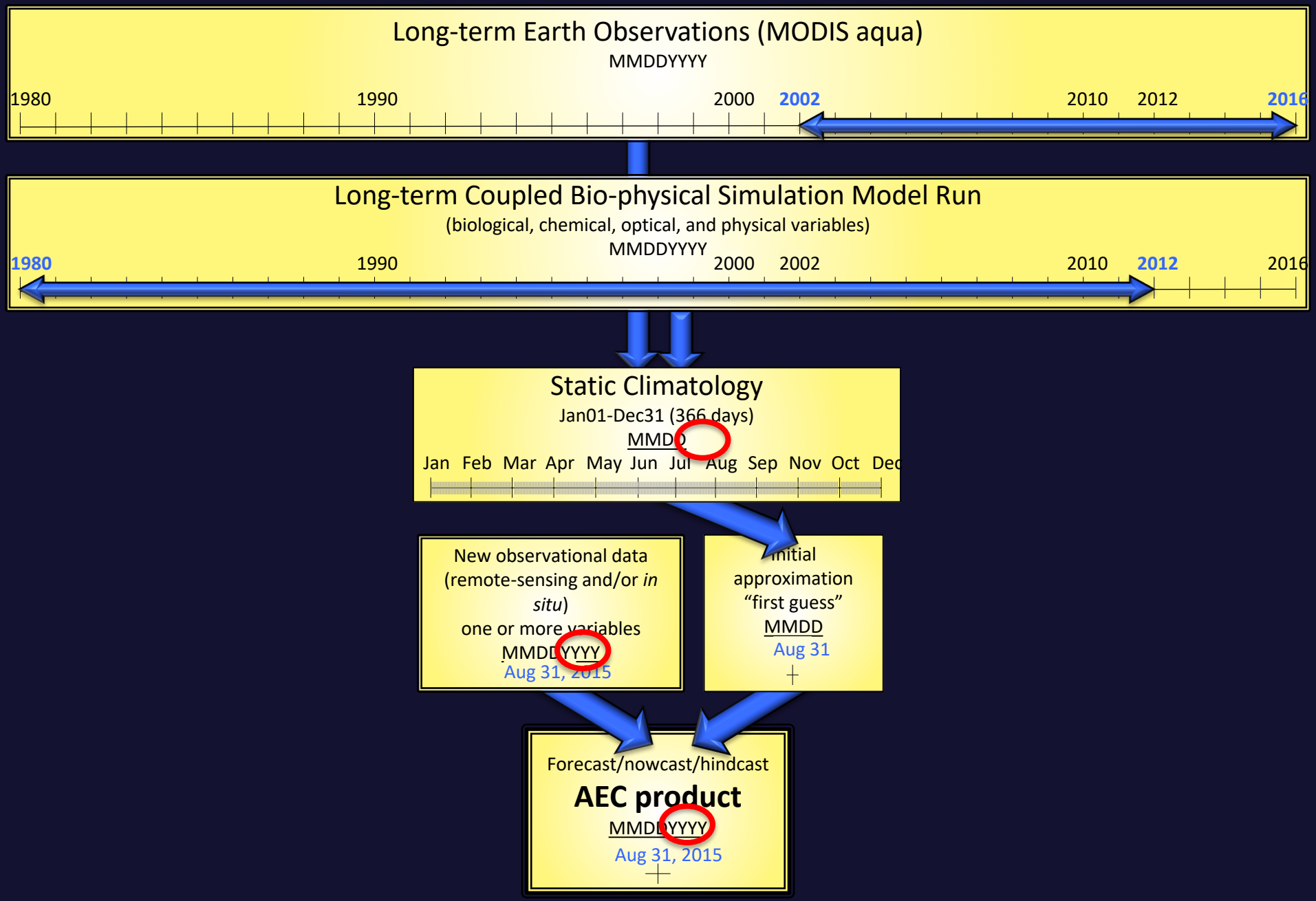
Product: An on-line decision support tool for ecological forecasting:

- gridded, 3-D fields
  - temperature, salinity
  - currents, sea-surface height
  - chlorophyll, phytoplankton
  - zooplankton
  - nitrate, ammonium, silicate, phosphate, oxygen
  - organic detritus
  - underwater photosynthetically available radiation (PAR)
- incorporate both climatological variability and real-time observations

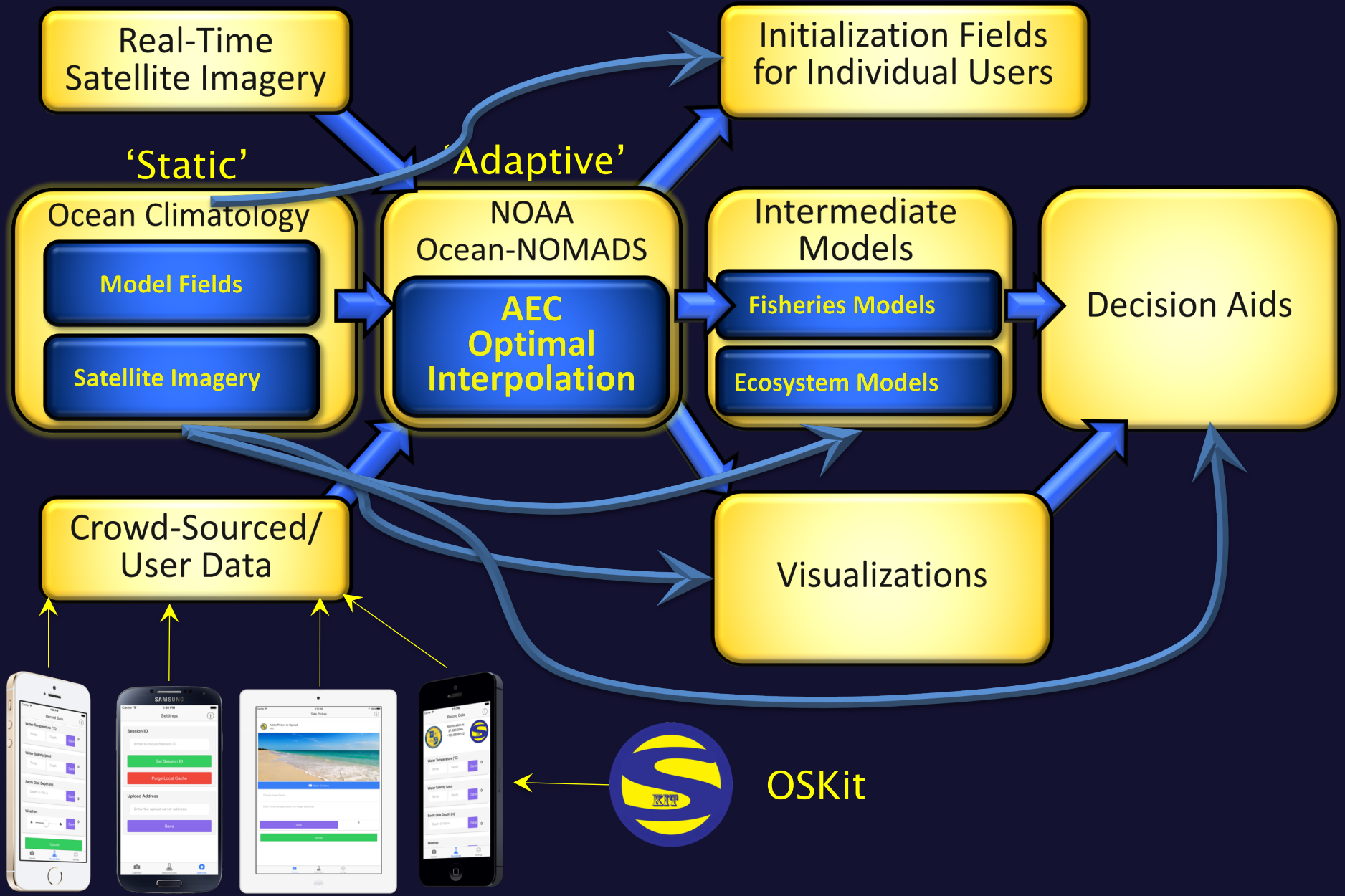
The AEC is based upon four elements:

1) a long-term, coupled biological-optical-physical simulation model run
2) Earth Observation (EO) time-series (remote sensing)
3) historical *in-situ* data
4) real-time remote sensing data and *in-situ* observations from government, academia, and the public (via a crowdsourcing 'app' for iOS and Android)

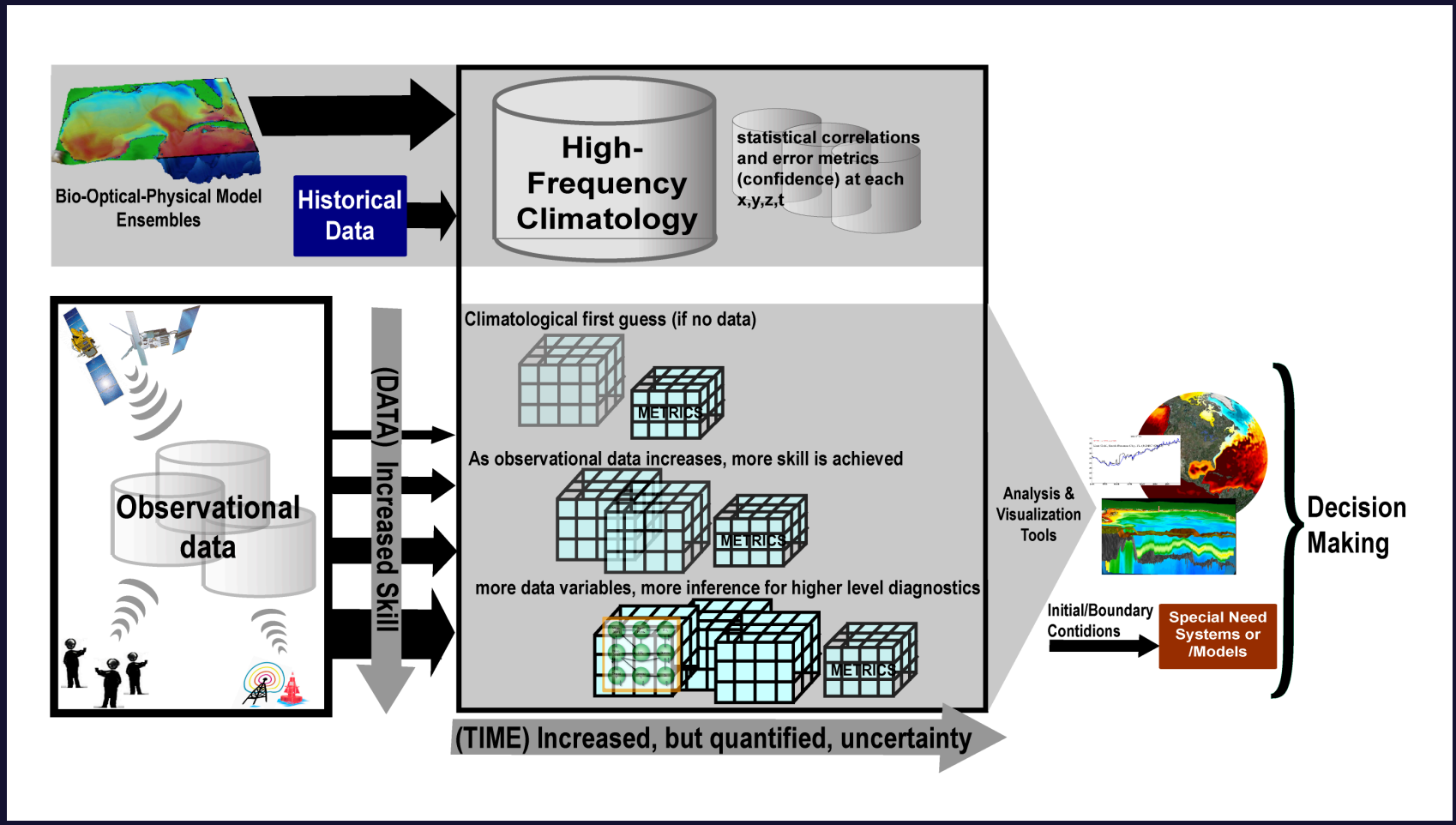
Adaptive Ecosystem Climatology - Development



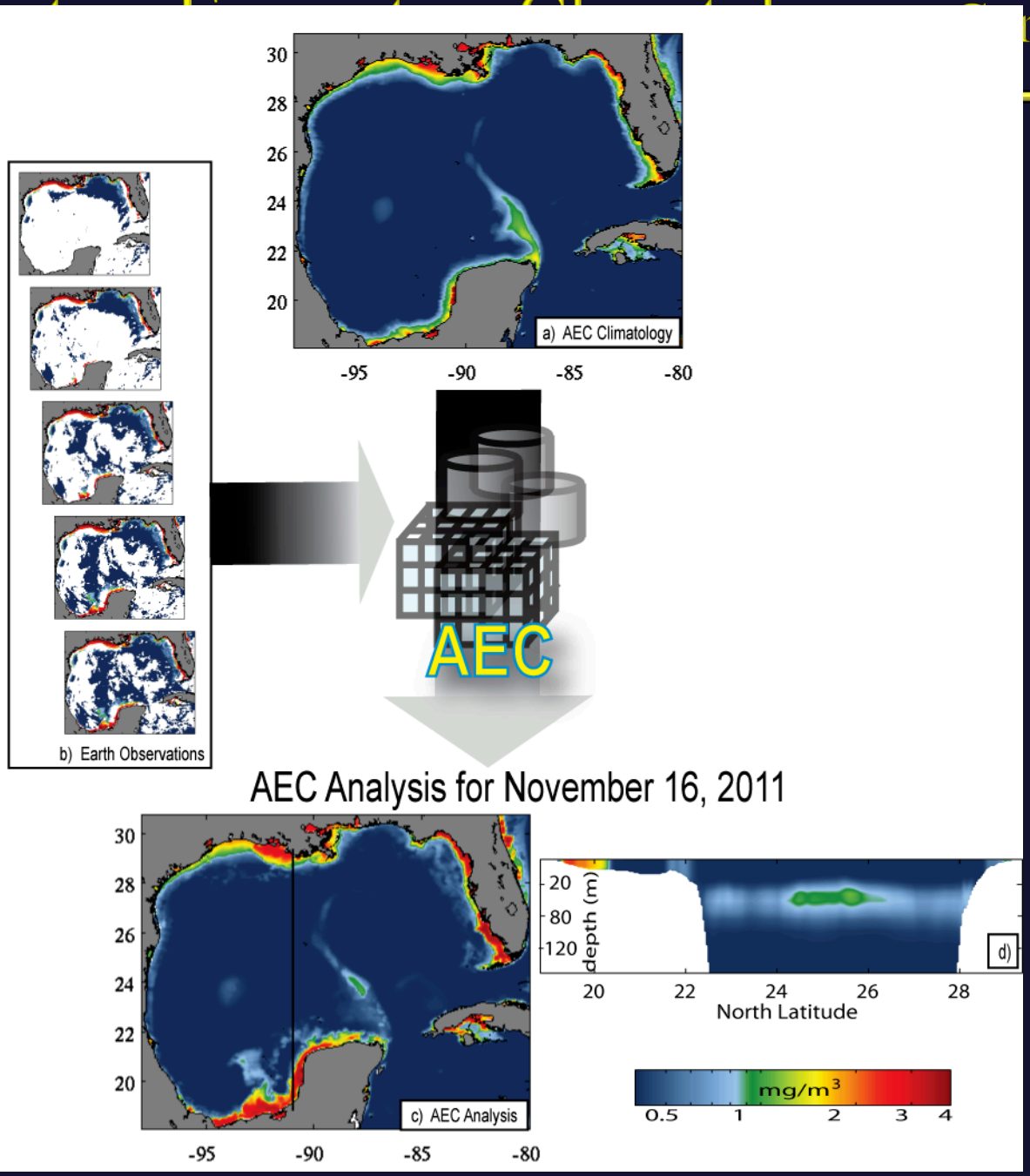
Adaptive Ecosystem Climatology - Flow



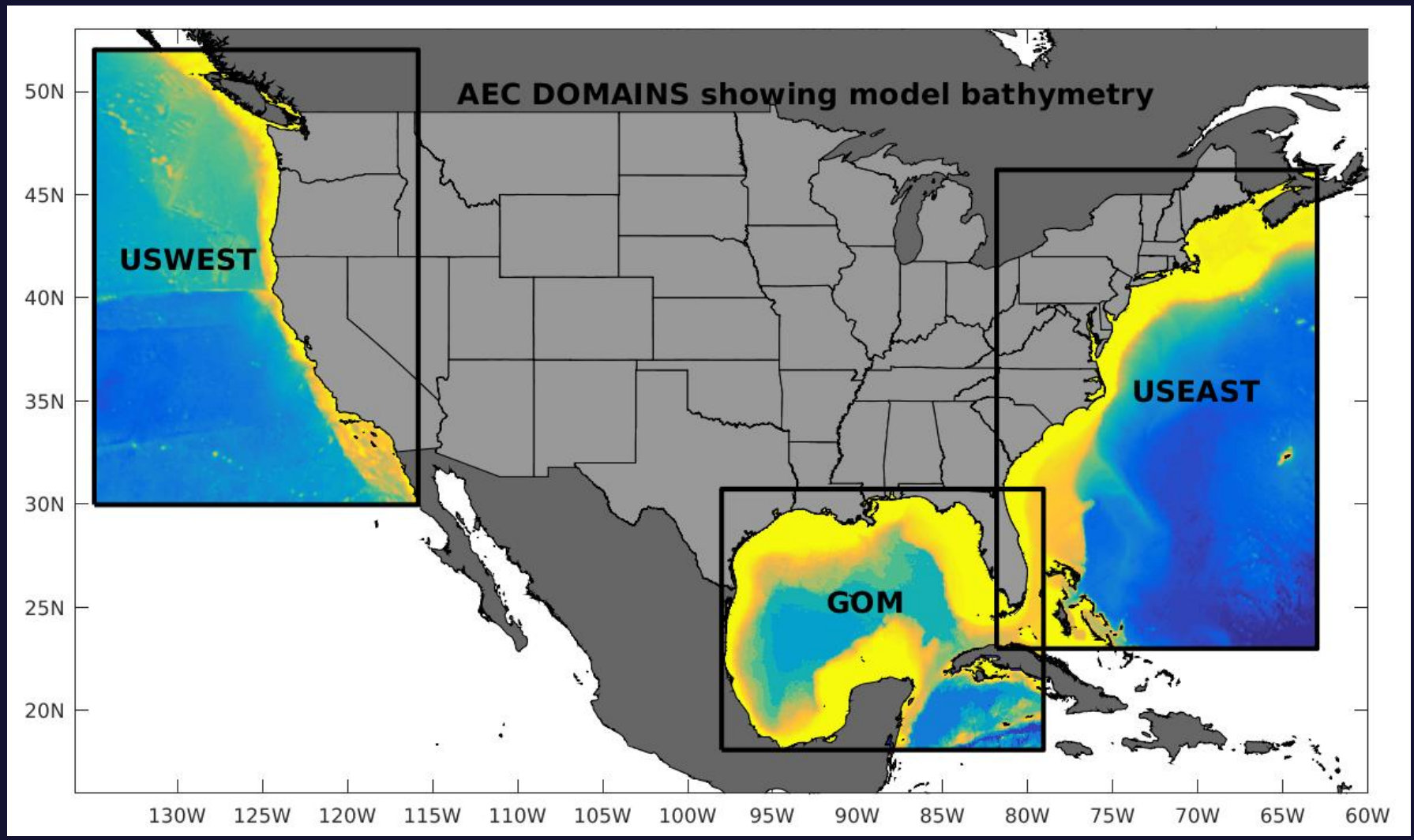
Adaptive Ecosystem Climatology - Concept



Ada ncept


30
28
26
24
22
20
a) AEC Climatology
-95
-90
-85
-80
b) Earth Observations
AEC
AEC Analysis for November 16, 2011
c) AEC Analysis
depth (m)
20
80
120
d)
North Latitude
mg/m3
0.5
1
2
3
4

ACE – CONUS (3 aggregate regions)



ACE – CONUS (3 aggregate regions)

Gulf of Mexico (available)18-30ºN x 79-98ºW

MODIS Aqua (2003-2013)

1 km resolution

- Chlorophyll
- Sea Surface Temperature

NCOM-COSINE Model (1980-2012)

4 km resolution

- Chlorophyll
- Plankton groups
- Physics

USWEST (available fall 2018)

29–53ºN x 115-135ºW

MODIS Aqua (2003 – 2016)

1 km resolution

- Chlorophyll
- Sea Surface Temperature

NCOM-COSINE Model (1999-2006)

9 km resolution (4 km in prep)

- Chlorophyll
- Plankton groups
- Physics

USEAST (satellite only)

24-46ºN x 64-82ºW

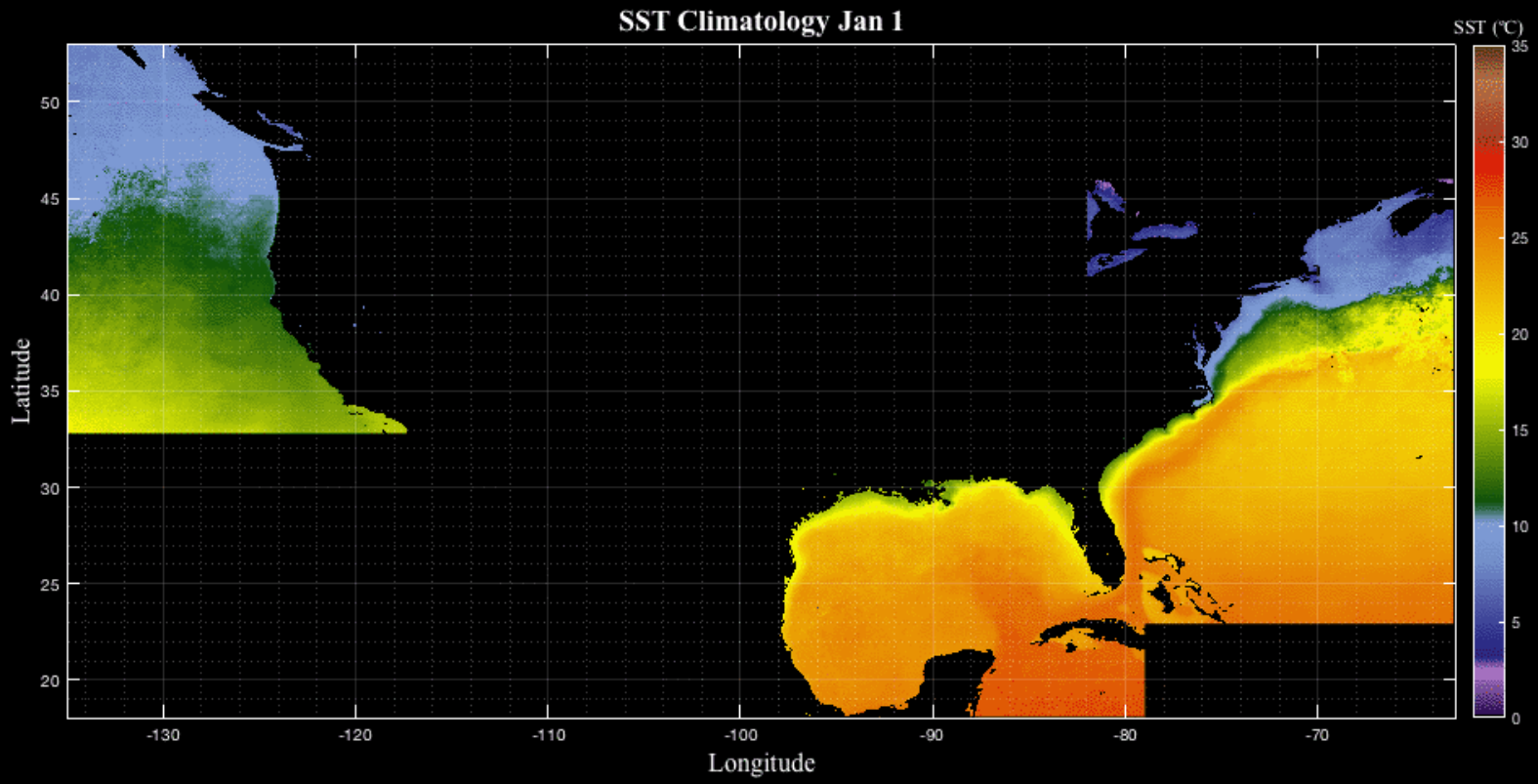
MODIS Aqua (2003 – 2016)

1 km resolution

- Chlorophyll
- Sea Surface Temperature

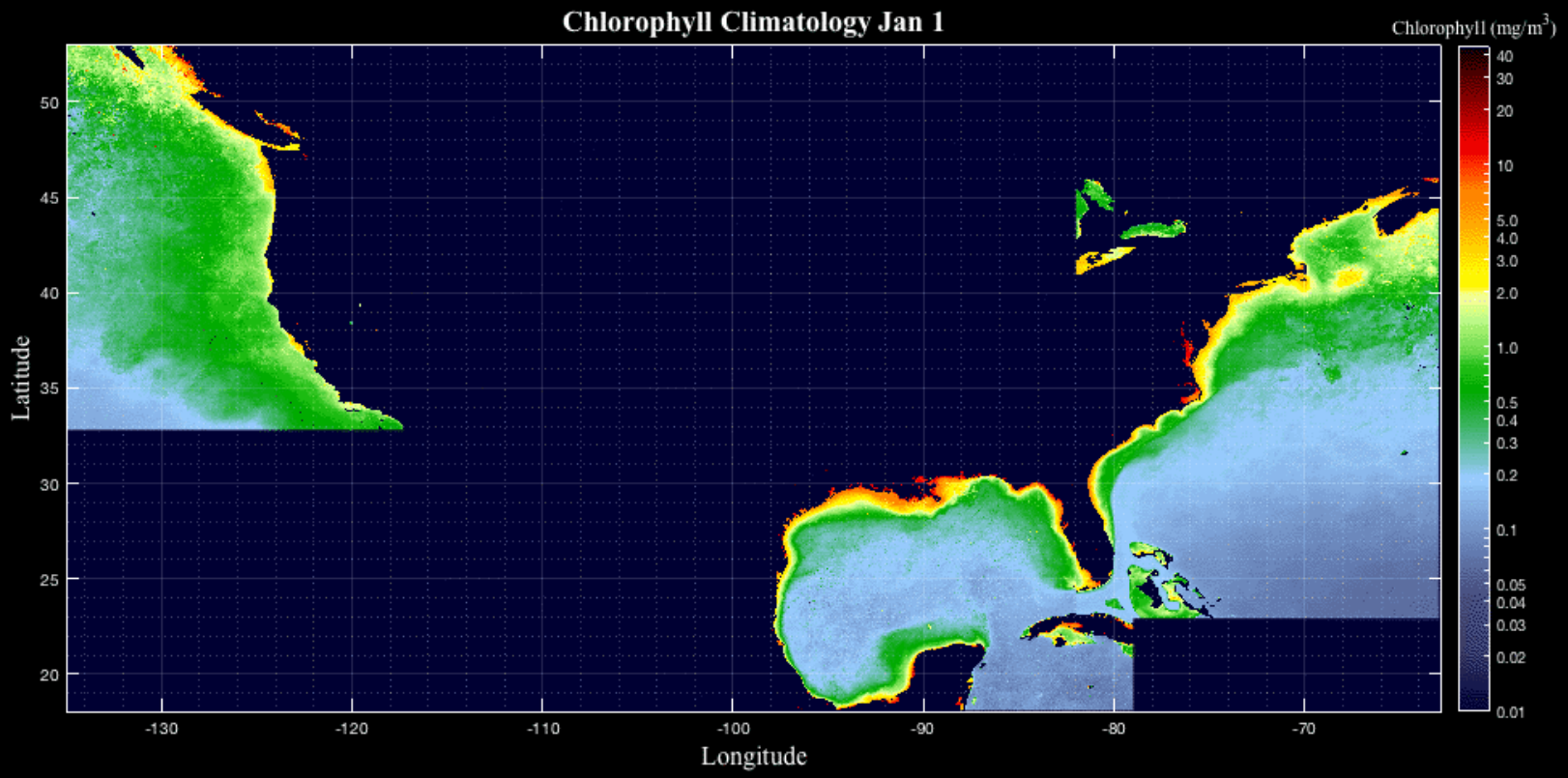
Adaptive Ecosystem Climatology - CONUS

SST Satellite Climatology



Adaptive Ecosystem Climatology - CONUS

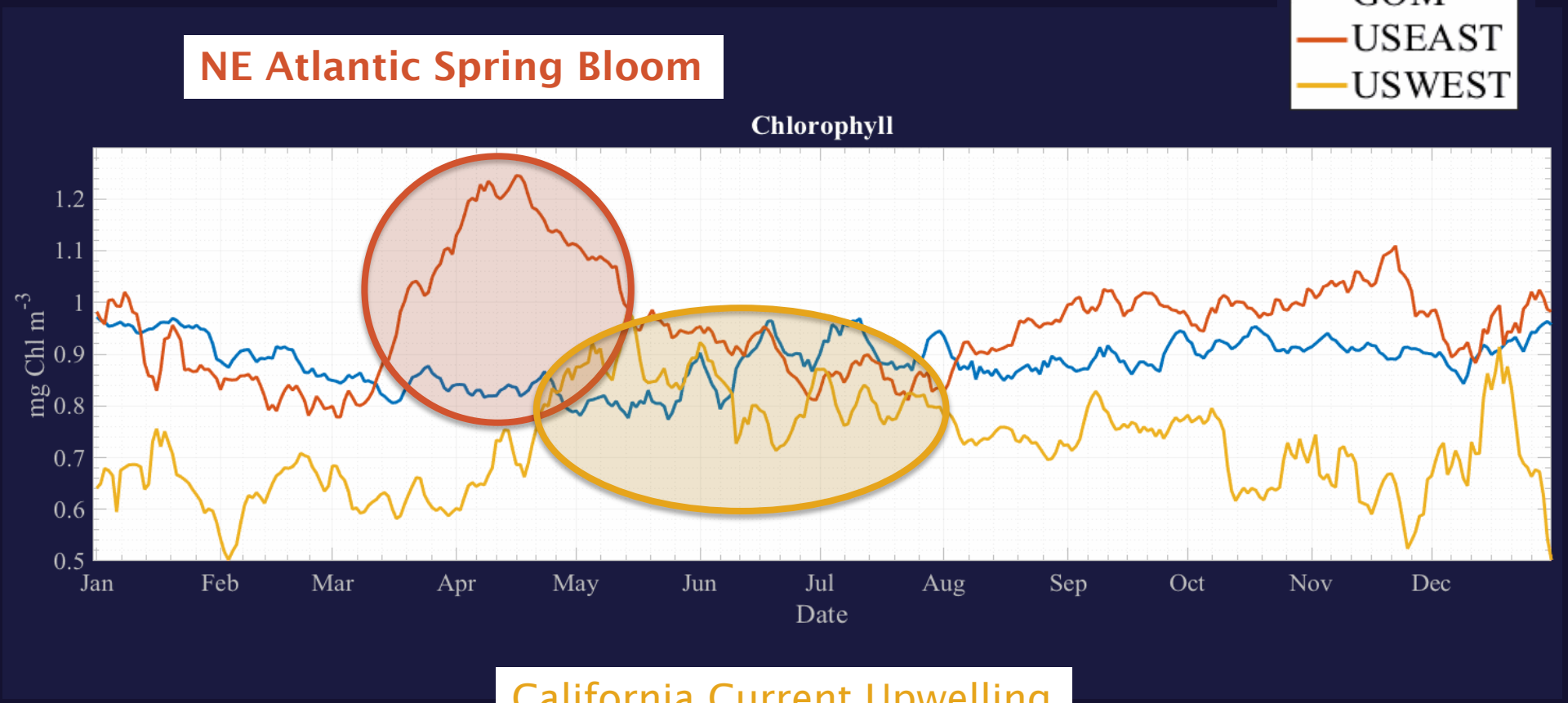
Chlorophyll Satellite Climatology



Adaptive Ecosystem Climatology - evaluation

Chlorophyll Satellite Climatology

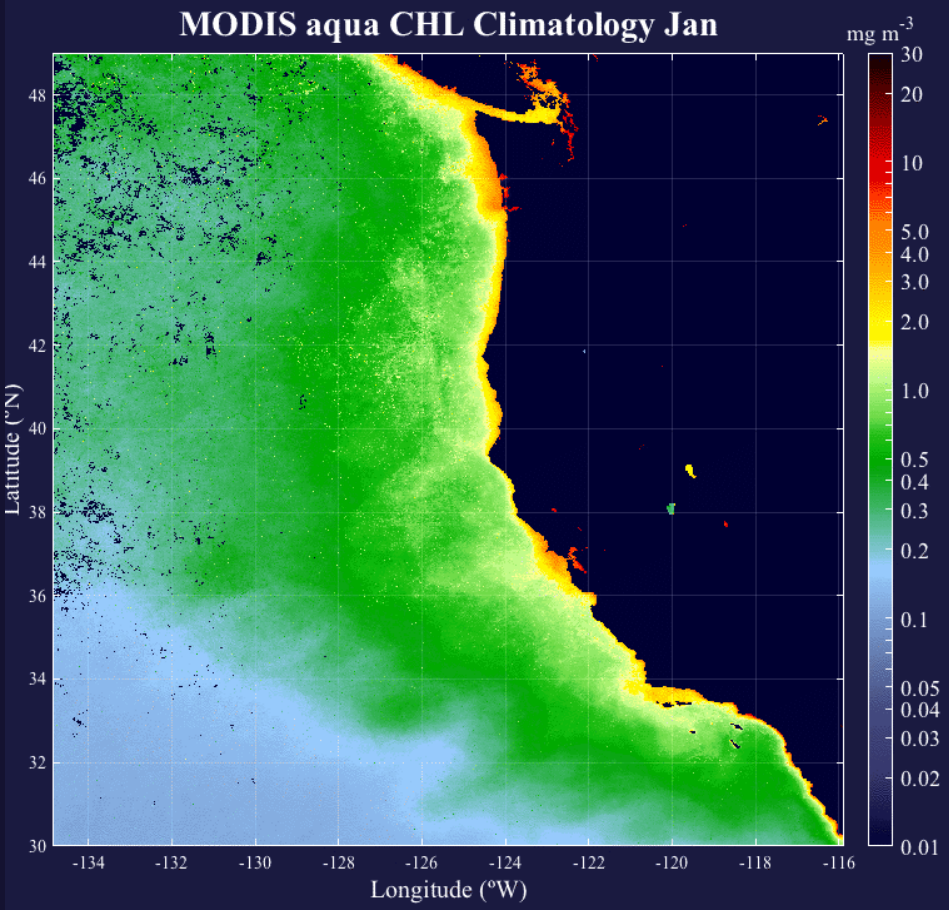
Domain-averaged timeseries



Adaptive Ecosystem Climatology - USWEST

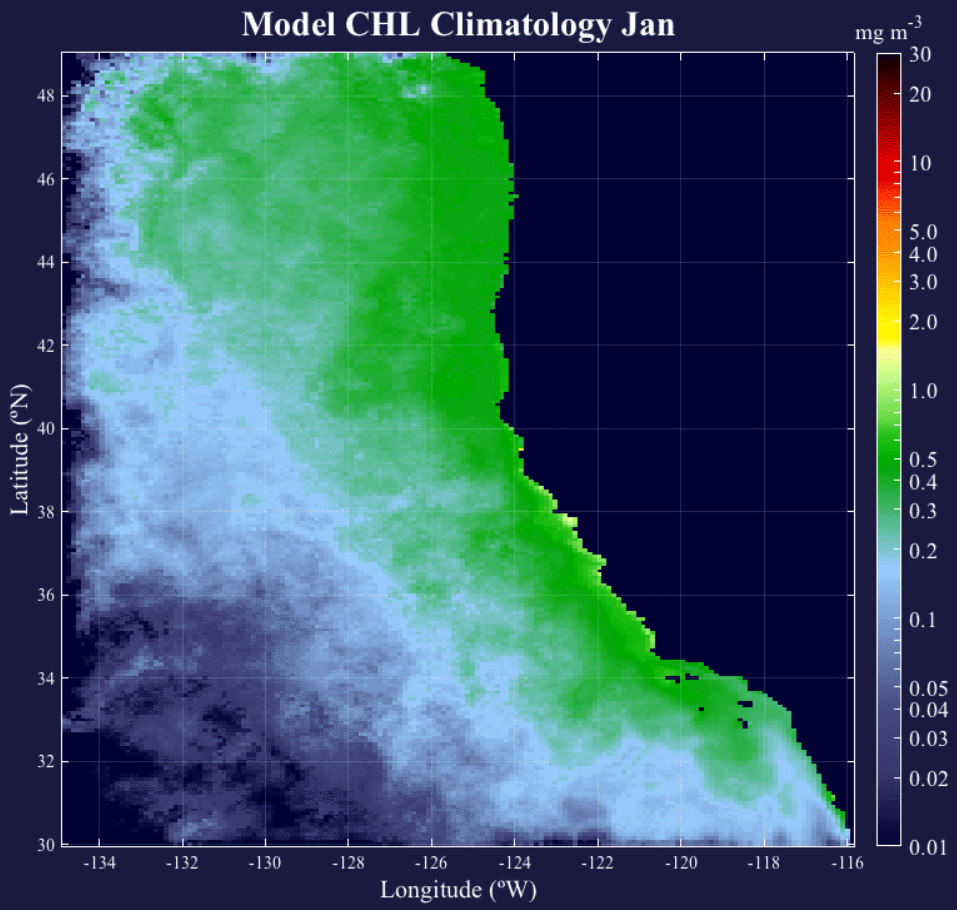
Chlorophyll Monthly Climatology

Satellite



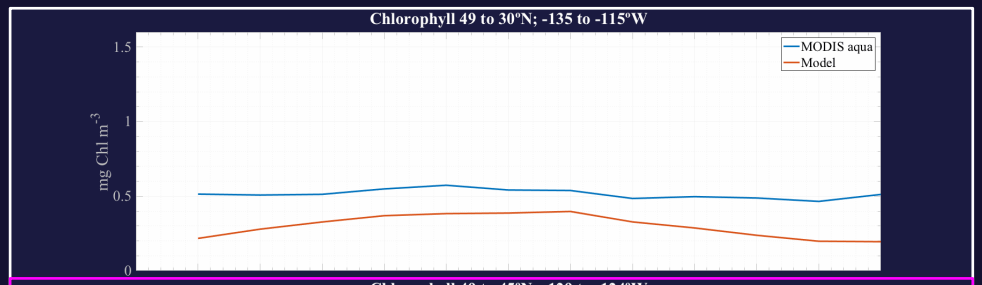
2003-2016

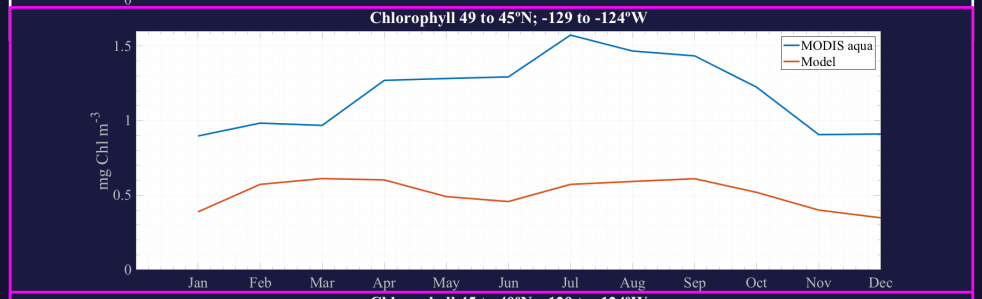
Model

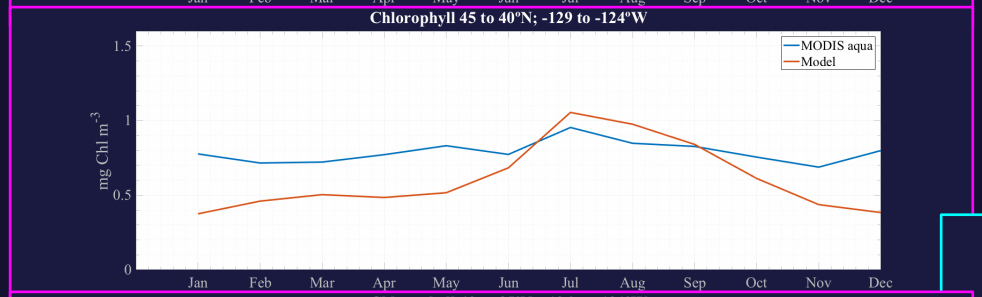


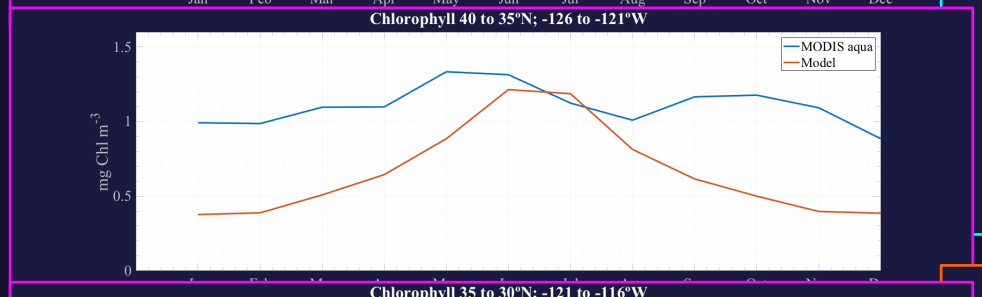
1999-2006

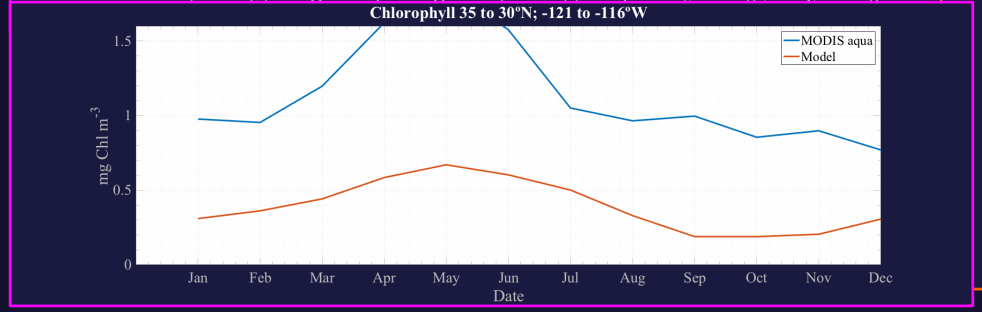
Will continue to 2018

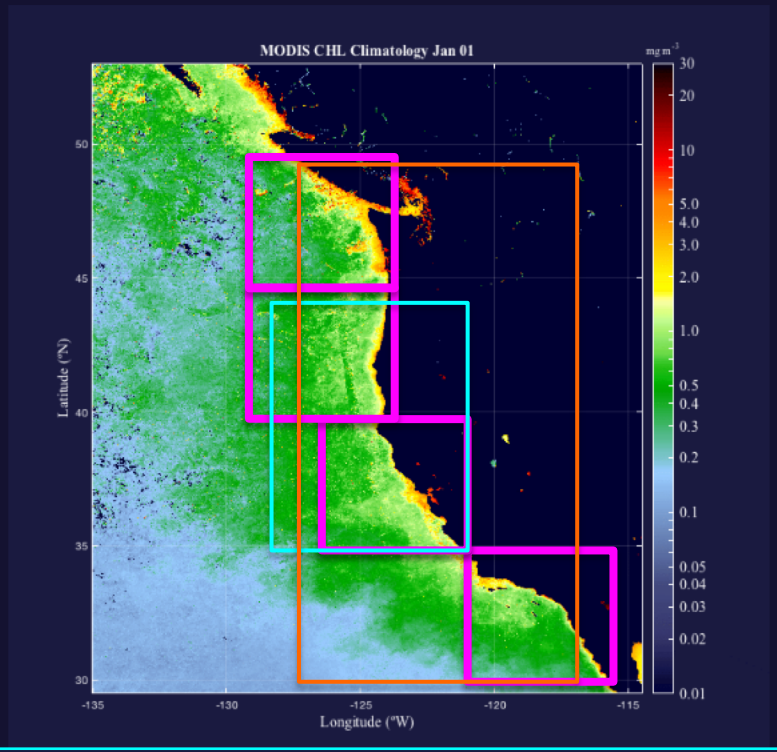

Chlorophyll 49 to 30°N; -135 to -115°W
MODIS aqua
Model
mg Chl m-3
0
0.5
1
1.5

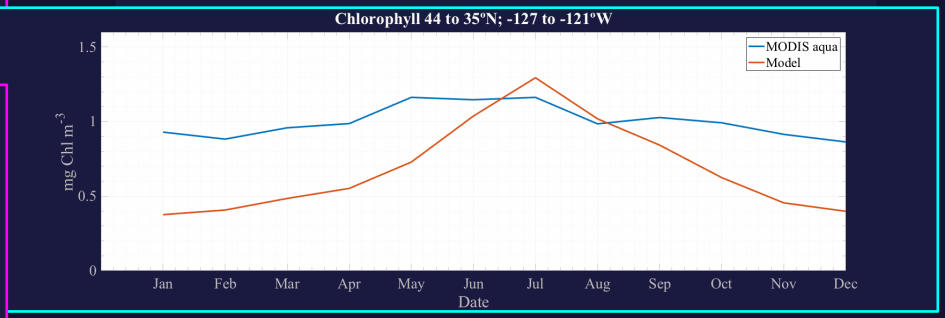

Chlorophyll 49 to 45°N; -129 to -124°W
MODIS aqua
Model
mg Chl m-3
0
0.5
1
1.5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

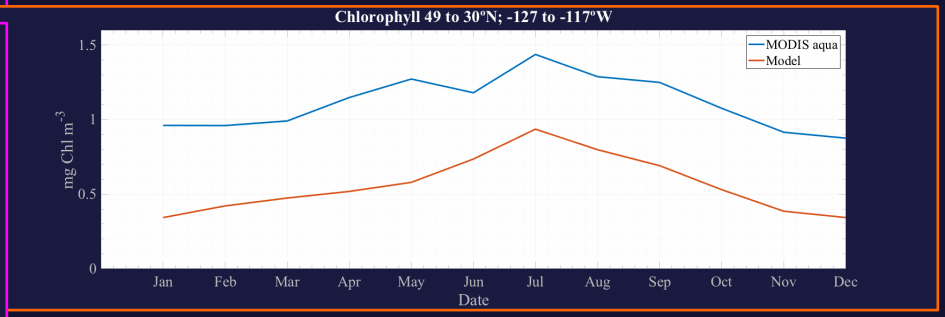

Chlorophyll 45 to 40°N; -129 to -124°W
MODIS aqua
Model
mg Chl m-3
0
0.5
1
1.5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Chlorophyll 40 to 35°N; -126 to -121°W
MODIS aqua
Model
mg Chl m-3
0
0.5
1
1.5


Chlorophyll 35 to 30°N; -121 to -116°W
MODIS aqua
Model
mg Chl m-3
0
0.5
1
1.5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date


MODIS CHL Climatology Jan 01
mg m-3
30
20
10
5.0
4.0
3.0
2.0
1.0
0.5
0.4
0.3
0.2
0.1
0.05
0.04
0.03
0.02
0.01
Latitude (°N)
50
45
40
35
30
-135
-130
-125
-120
-115
Longitude (°W)


Chlorophyll 44 to 35°N; -127 to -121°W
MODIS aqua
Model
mg Chl m-3
0
0.5
1
1.5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date


Chlorophyll 49 to 30°N; -127 to -117°W
MODIS aqua
Model
mg Chl m-3
0
0.5
1
1.5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date

AEC – Web Portal(s)

AEC OceanNOMADS
Production server at NOAA Data Center (now NCEI)
Nashville, TN

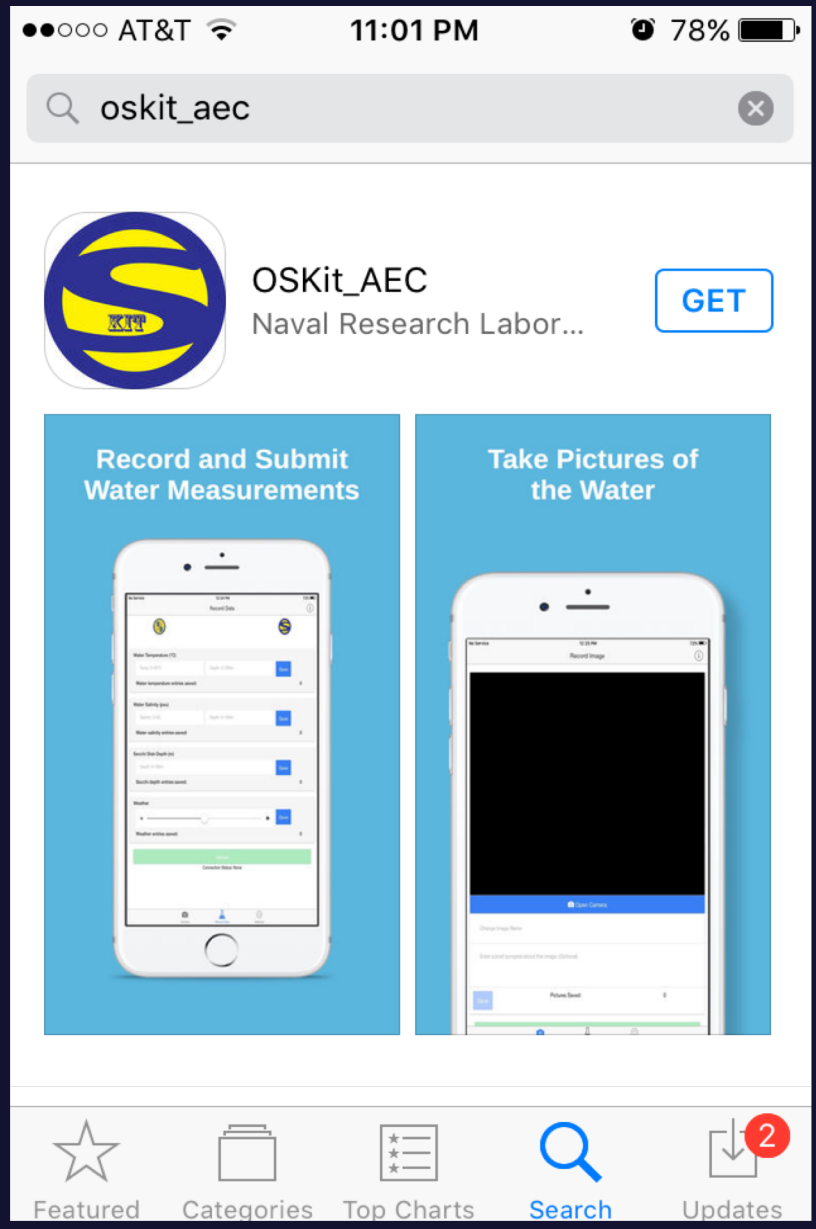
https://www.ncdc.noaa.gov/data-access/model-data/model-datasets/nrl-aec

AEC Real Time OI (Gulf of Mexico)
Development server at NRL
Stennis Space Center, MS

https://www7330.nrlssc.navy.mil/derada/AEC/

AEC – OSKit

OSKit App
On the Apple App Store



OSKit RoV
Delivered to 2 high-schools

Crowdsourcing:

Adaptive Ecosystem Climatology – Thanks!

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